Performance Deferred Share Program Valuation

The Performance Deferred Share Program (PDSP) has been established by an organization to compensate eligible employees for their contribution to the long-term performance of the organization.

The final payout to the employee depends on the organization's performance against its peer group. The PDSP valuation model is an attempt to value this liability taking this performance aspect into account.

For each award granted, 50% of the award consists of "regular" shares, while the remaining 50% are "performance" adjusted. The payout on the performance shares is adjusted based on how organization's total shareholder return (TSR) compares to the peer group.

For the regular shares, the shares "vest" in three years from grant date, with dividends granted reinvested in shares. The final payout is based on the of the initial number of shares, included reinvested dividends.

The payout is adjusted based on this ranking as follows:

• If the organization's TSR falls in the first quartile, the number of the performance shares will be increased by 50%

• If the organization's TSR falls in the second quartile, the number of the performance shares will be increased by 25%

• If the organization's TSR falls in the third quartile, the number of the performance shares will be decreased by 25%

• If the organization's TSR falls in the fourth quartile, the number of the performance shares will be decreased by 50%.

As for the regular shares described above, in the Canadian program the increase or decrease will be applied to the number of shares at the end of the program including reinvested dividends. In the US program, since dividends are paid through the vesting period, only the original grant will be increased.

In order to value the payout of the performance deferred shares, one needs to model (see https://finpricing.com/lib/EqWarrant.html) how the TSR will compare to the peer group at some future date. In order to do this, a correlated log-normal model was used to model the share price of each organization:

$$S_i(t) = S_i(0)\exp[(\mu_i - \frac{\sigma_i^2}{2})t + \sigma_i\sqrt{t}\epsilon_i]$$

where i represents each share TSR, μi is the assumed drift, _i the volatility and _i is a standard normal (correlated). For each i, Si(0) will be taken to be the grant date share price inflated by the TSR to date. This of course is the actual share price increase from grant date to valuation date, and inflated to include reinvested dividends.

Since we are modelling total shareholder return where the dividends are being reinvested, we can assume the drift for the TSR's to be he risk free rate for each i. In fact, since the value will be eventually present valued using the same risk-free rate, the risk free rate is not even required in the model. A long-term historical average is taken for the volatility, as it is for the correlation. These appear to be reasonable assumptions to make.

As stated earlier, it will be necessary to compare the organization's TSR against the peer group. For all three years of interest, one way to compare the performance of each bank would be to evaluate

$$TSR_i = \frac{S_i(T)}{S_i(0)} - 1$$

where t = 0 represents valuation date and t = T is entitlement date (here and everywhere else we will consider t in days, since a daily volatility is used in the model). As stated, eerier, Si(0) is calculated including already reinvested dividends, and Si(T) includes reinvested dividends by virtue of the fact that a risk-free rate is assumed in the process for Si. For simplicity, we will call this way of comparing TSR over the period as the "spot" comparison.

An alternate method of calculating this is based on a much more complicated "average" TSR over the whole period. The idea is to calculate the TSR for each share calendar quarter to quarter, and finally take an average return. Let Tq represent the time for the various quarter ends for q = 1, .., 12. The actual calculation being done is further complicated by the fact that these TSR values are calculated using "average" quarter end values. Define

$$S_i^B(T_q) = \frac{1}{5}\sum_{j=0}^{4} S_i(T_q - j)$$

to be the "backward" average and

$$S_i^F(T_q) = \frac{1}{5}\sum_{j=1}^{5} S_i(T_q + j)$$

to be the “forward” average. The calculation of the total shareholder return over that quarter is given by

$$A_i(T_q) = \frac{S_i^B(T_a)}{S_i^F(T_{a-1})},$$

and finally, the average TSR for each bank is the simple average of Ai(Tq) over all (12) quarters.

The peer group comparison is done in a slightly different way. In particular, a similar “average” TSR (over the 12 relevant quarters) is calculated. The difference in the US program is that the quarter-to-quarter averages are now based more simply on the closing dates, rather than the 9 days surrounding quarter end. Otherwise, the calculation is exactly as described above.

it would be possible to correctly value the deferred shares under the same assumptions being used regarding the dynamics of the share prices. However, Finance uses and approximation by using the output of the model and effectively ignoring the strong correlation between the share results and the multiplier that would apply